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Notes on Japanese Polyclad Turbellarians.

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With 8 Figures in Text.

The polyclads serving as basis for the present paper were collected by Dr. Madoka Sasaki in 1918 and 1922 in the neighbourhood of the Oshoro Marine Biological Station in Hokkaido. Small as the collection is, it proves a most interesting one that is found to embrace specimens of two new species out of a total of four species in all. Though not all of the Polyclads inhabiting this region, the four species probably represent the more common forms. Of the two new species described in this communication one appears to be of great interest on account of representing a member of the genus *Yungia* which, so far as I can learn, have hitherto been unrecorded from the territories of Japan. Characteristic of this genus is the presence of the external openings of some intestinal diverticulae on the dorsal surface of the body.

Before proceeding farther, I should like to thank Dr. Sasaki for placing at my disposal the interesting specimens, as well as some coloured sketches taken while the worms were living. Particularly it may be mentioned here that the original preparation of the accompanying Text figure 4 was made by him.

**Notoplana humilis** (Stimpson).

(Text fig. 1.)

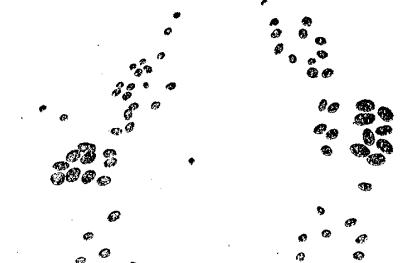
*Leptoplana humilis*, Stimpson 1857, Proc. Acad. Nat. Sci. Phil., IX, 4, 9.—Diesing 1850, Sitzs-ber. d. math.-nat. Cl. d. kais. Akad. d. Wiss. Wien, XLIV, 533.—Lang 1884, Naples Monogr., 496.

*Notoplana humilis*, Yeri and Kaburaki 1918, Jour. Coll. Sci. Imp. Univ. Tokyo, XXXIV, Art. 9, 11-13.

The collection was found to comprise only a single immature specimen which, though showing a slight difference in the arrangement of eye-spots, may probably be referable to *Notoplana humilis* of fairly wide distribution in the Empire. This species has been known to occur in the neighbourhood of the Misaki Marine Biological Station, at Shirahama in Prov. Awa and also at Otaru in Hokkaido.

As described in detail in the previous paper in conjunction with Mr. Yeri, the body, while the animal was living, was of an elongate shape with a broadly rounded anterior end. The lateral margins of the body were even and nearly parallel for a large part of its length, but gradually became narrower in the hind parts to a bluntly pointed posterior extremity. The specimen was 25 mm. in length and 7 mm. across in the cephalic region. In the preserved condition the body is of an elongate oval shape and measures about 7 mm. long by 3 mm. broad. No trace of tentacles has been found in the specimen preserved.

The dorsal surface was of an olive-buffy colour becoming more intense toward the median parts. A long paler space was seen over the pharyngeal region. Sparingly scattered over the entire dorsal surface are numerous dark pigment spots, though they are very faint in the preserved condition.



Text fig. 1. Arrangement of eye-spots in *Notoplana humilis* (Stimpson).

Differing from the condition figured in the previous paper, the cerebral group of eye-spots, though presenting an elongate cluster just mediad to the tentacular one that comprises a small number of the eyes, is divided by the brain into an anterior and a posterior cluster, as is seen in Text fig. 1. The difference, however, I feel advisable to regard as being of not more than varietal value.

**Pseudostylochus obscurus** (Stimpson).

(Text figs. 2, 3.)

*Stylochus obscurus*, Stimpson 1857, Proc. Acad. Nat. Sci. Phil., IX, 4, 11.—Diesing 1850, Sitzs.-ber. d. math.-nat. Cl. d. kais. Akad. d. Wiss. Wien, XLIV, 566.—Lang 1884, Naples Monogr., 464.

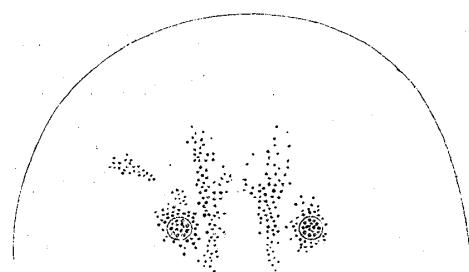
*Pseudostylochus obscurus*, Yeri and Kaburaki 1918, Jour. Coll. Sci. Imp. Univ. Tokyo, XXXIV, Art. 9, 30, 31.

The present species appears to be of fairly wide distribution in Japan, as it is known to occur at Misaki, at Mera in Prov. Awa, and also at Otaru in Hokkaido. Five examples, which may be identical with this species, were found included in the collection.

While the worms were living, the body was of a moderately firm consistency and of an oval or elliptical shape with the anterior end more broadly rounded than the posterior. In the preserved state it measures 13-17 mm. in length and 8 mm. across at the middle.

The tentacles appeared as a pair of small conical processes, each placed near the commencement of the second quarter of the body.

The colour of the dorsal surface was olive-buffy with minute dark brownish pigment spots uniformly scattered all over. The uterine canals could be seen with more or less distinctness in two paler streaks, closely skirting the pharynx. The ventral surface was of a much paler colour than the dorsal.



Text fig. 2. Arrangement of eye-spots of *Pseudostylochus obscurus* (Stimpson).

Not only are the eye-spots distributed in and about the tentacles, but also they occur over the brain region in two irregular elongate tracts, as is shown in Text fig. 2. Occasionally there can be seen an adventitious tract of eye-spots just antero-lateral to the tentacular group of eyes on the left side.

Obviously differing from the condition in the Stylochid-species, no eye-spots exist on the frontal margin of the body.

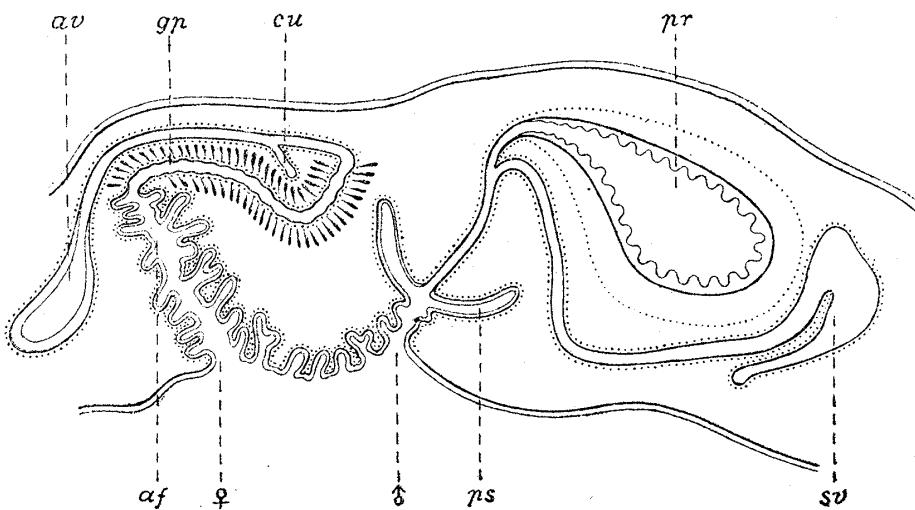
Made up of closely apposed columnar cells is the epidermis which is of a greater height on the dorsal than on the ventral side. As is the case with the majority of species, the epidermis contains minute slender rhabdites which are more abundant on the former than on the latter. The dermal musculature, coming just beneath the thin basement membrane, is better developed ventrally than dorsally and consists of the outer circular layer of very delicate and somewhat indistinct nature, the outer longitudinal layer of moderate thickness, the inner circular layer of great thickness and the inner longitudinal layer. Dorsoventral fibres occur in several parts of the body. Deeply embedded in the body-parenchyma are numerous glands which open to the exterior in a narrow zone of the ventral surface along and within the margin of the body.

Slightly in front of the centre of the body and a little behind the middle of the pharynx occurs the mouth which leads into the pharyngeal chamber with the plicated pharynx, a great deal shorter than one-third as long as the body. The main trunk of the intestine sends out about 10 pairs of lateral branches which are repeatedly subdivided before reaching the margin of the body. The ultimate divisions of the intestine have never been seen to anastomose. The epithelium of the intestine presents nothing peculiar, consisting, as it does, of two sorts of cells, glandular and non-glandular, of which the latter sort is the more numerous.

Posterior to the pharynx and near the hind border of the middle third of the body there exist the gonopores, male and female, which are slightly apart.

Structurally the genital organs are in accord with those described in the previous paper in unison with Mr. Yeri. Embedded in the parenchyma, on the ventral side, are numerous small testicular follicles which contain sperm-cells in several stages of development. In the sections available I could not trace any course of the canals leading from the testes. The vasa deferentia, one on each side, extend back as far as the level slightly behind the pharynx and unite into a single duct which

proceeds in an anterior direction for a short distance and is continued into the wide seminal vesicle filled up with spermatozoa. The vesicle abruptly turns backward, gradually narrows at the same time and passes into the slender ejaculatory duct. After receiving the opening of the prostate, the duct makes an abrupt, oblique-posteriorly and downwardly directed bend, finally to open at the apex of the penis. The prostate is a large pear-shaped gland and occupies a position immediately postero-dorsal to the seminal vesicle. Its direct wall is formed of a strongly folded epithelium of glandular nature, outside which lies a thick muscular layer composed of interlacing circular fibres. The penis represents a short conical body of moderately large size and projects into its sheath, which opens out through the gonopore.



Text fig. 3. Diagram of genital organs of *Pseudostylochus obscurus* in sagittal section. *af* antrum femininum, *av* accessory vesicle, *cu* common uterine canal, *gp* glandular passage, *pr* prostate, *ps* penis-sheath, *sv* seminal vesicle, ♂ male gonopore, ♀ female gonopore.

The ovaries abundantly occur distributed over the dorsal half of the body, but the ducts connecting them are invisible in the sections available. The uteri, on the other hand, are clearly defined and dilated by a considerable number of ripe ova. They have their origin just in front of the pharynx. From here they run backward, clearly skirting the pharynx, behind whose posterior extremity they near the median line

and finally unite into a short common duct, which soon joins a wide canal on the ventral side. From this junction-point the canal extends posteriorly to enter the small accessory vesicle, the wall of which is composed of a thick glandular epithelium and a fine muscular layer. Anteriorly the canal makes an abrupt downward and backward bend and, after receiving the openings of numerous glands, passes into the tolerably wide antrum, whose wall projects to a considerable extent into its lumen in folds. The glandular canal is lined by a ciliated epithelium of columnar cells outside which comes a muscular layer made up of two sets of fibres, circular and longitudinal.

### *Yungia sasakii* sp. nov.

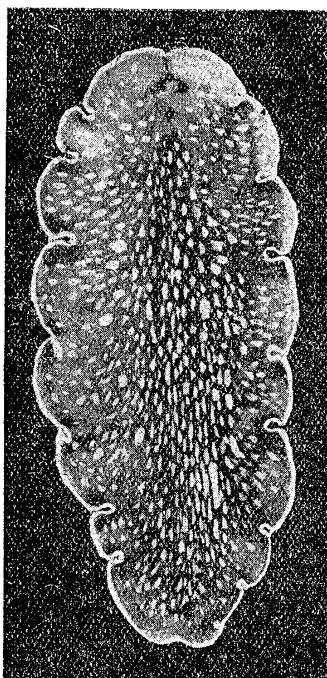
(Text figs. 4—6.)

Some interest attaches to the occurrence, in our territories, of an interesting species referable to the genus *Yungia*. The new species here described is represented by two examples.

According to Dr. Sasaki's sketch, the body was of very firm consistency and of a nearly oval shape with a strongly frilled margin. Its anterior end was more broadly rounded than the posterior. The tentacles appeared as two folded loops of the frontal margin of the body. In the preserved condition the larger specimen measures 45 mm. long by 22 mm. across at the middle of the body.

Although buffy brown, instead of reddish orange, on the dorsal surface, this species presents a close resemblance in colour to *Yungia aurantiaca* Delle Chiaje<sup>1</sup>,

Text fig. 4. Semidiagrammatic sketch of *Yungia sasakii* sp. nov.



1) Lang 1884, Naples Monogr., 548.

being marked with a thin white marginal band running nearly all round the body, except on the margin of the tentacle where the colour was dark brown. Further, uniformly distributed all over were numerous white spots, that are of varying size, but are a great deal larger than in *Yungia aurantiaca*. A long bar of a much deeper colour extended along the mid-dorsal line from the front of the pharynx to near the hind end. Very slight as the distinctions between the two species are, they may be found in the different colour of the margin of the tentacles as well as in the different dimension of white spots on the dorsal surface.

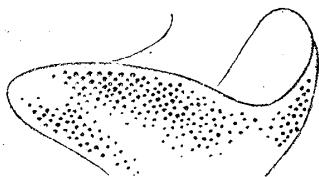
Scattered over each tentacular flap are numerous minute eye-spots which form two irregular groups, as is shown in Text fig. 5. Near the base of the tentacular fold, in the median line, are the cerebral eye-spots which occur in two imperfectly separated groups.

As is usual, the epidermis is made up of columnar cells in close contact. No rhabdites could not be found in the epidermis.

The underlying dermal musculature is more feebly developed as compared with that in the preceding species, consisting of three layers, the outer circular, the middle longitudinal and the inner circular. Of those the outer circular layer is of very delicate and somewhat indistinct nature. Ventrally in some parts there exists a layer of longitudinal muscular fibres just inward to the inner circular muscles.

The sucker is a small cup-like disc placed in the mid-ventral line near the anterior border of the middle third of the body, and receives the openings of numerous glands embedded in the body-parenchyma.

Not far behind the frontal margin of the tentacular flap is seen the mouth which leads into the pharyngeal chamber with the small pharynx of a nearly cylindrical shape. Posteriorly the pharynx passes into the main trunk of the intestine which extends almost throughout along the median line, sending out some paired lateral branches which in turn are



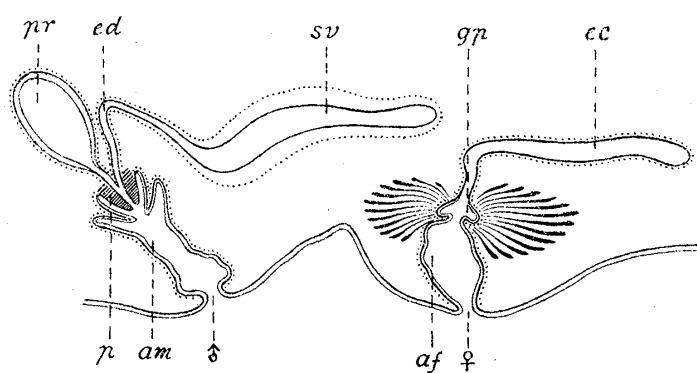
Text fig. 5. Arrangement of eye-spots in *Yungia sasakii*.

numerously subdivided to form an anastomosing system. Dorsally the main trunk and branches give rise to numerous small diverticulae which connect in part with one another so as to form an intercommunicating system. Some of the diverticulae, though not clearly made out owing to an unsatisfactory state of preservation, appear to open out on the dorsal surface, as is the case with *Y. aurantiaca*. In order to deal fully with this respect more material is necessary.

Slightly behind the mouth are found the male and female gonopores which are tolerably apart.

Numerous testes are distributed over the ventral half of the body, but the canals leading from them are invisible in the sections available. The vasa deferentia, each proceeding in an anterior direction on either side, pass inward toward the median line to unite near the female gonopore into the wide siminal vesicle which is provided with a considerably thick muscular wall consisting of interlacing circular fibres. Anteriorly the vesicle gradually narrows to form the ejaculatory duct which makes an abrupt bend downward. After receiving the duct of the prostate from the front, the ejaculatory duct opens at the apex of the penis. The prostate is a pear-shaped gland, its direct wall being formed of a thin glandular epithelium, external to which comes a muscular layer of moderate thickness.

The penis is of a small conical shape and almost vertically projects into the penissheath, which is continued into the moderately wide tubular antrum, forming an irregularly wide space slightly inward to the gonopore; in this respect the



Text fig. 6. Diagram of genital organs of *Yungia sasakii* in sagittal section. *am* antrum musculinum, *ec* egg-canals, *ed* ejaculatory duct, *♂* penis. Other letters as in Text fig. 3.

larly wide space slightly inward to the gonopore; in this respect the

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present species is obviously different from *Y. aurantiaca*. No chitinous stylet could be found in this species.

The ovaries are dorsal in position. The uteri, each running on either side of the main gut trunk, are so greatly inflated by a great number of ova. Not far behind the female gonopore they fuse and send forward a canal, which proceeds in an anterior direction for a short distance and then makes an abrupt downward bend to continue into the small glandular passage. Embedded in the parenchyma around the passage are numerous unicellular glands, the secretions of which it receives. The glandular passage in turn connects with the antrum of an irregular contour.

Closely allied to *Y. aurantiaca* Delle Chiaje of the mediterranean by its colour and markings, the present species differs sufficiently in the structure of the genital organs, as may be seen from the above.

***Eurylepta punctata* sp. nov.**

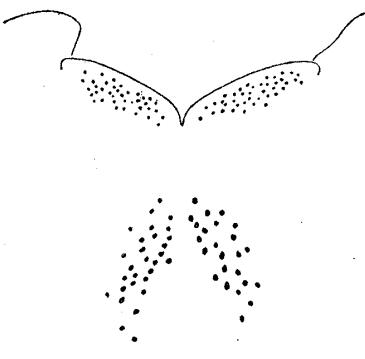
(Text figs. 7, 8.)

This new species is based upon a single specimen preserved in formalin. The body is moderately firm in texture and of an irregularly oval shape with the anterior end, a great deal wider than the posterior. It measures about 13 mm. long by 10 mm. broad at the middle of the body. The tentacles appear as two short outgrowths of the frontal margin of the body.

At a glance the present species exhibits an appearance almost similar in colour to *Cycloporus papillosus* Lang, being pinkish olive with a slight touch of a violet tint. The entire dorsal surface are blotched with minute dark brownish pigment spots in great abundance, though the spots are generally of small size. The ventral surface is much paler than the dorsal.

Numerous eye-spots are distributed on the tentacles in two distinct irregular clusters, while two somewhat oval-shaped groups anteriorly converging occur dorsal to the brain (Text fig. 7).

The epidermis is of a greater height on the dorsal than on the ventral side, and contains slender rhabdites in sparse numbers. The underlying dermal musculature is very thin and consists, as in the preceding, of three layers, the outer circular, the middle longitudinal and the inner circular. Embedded in the dorsal parenchyma are numerous pigment granules which are of an olive colour.

Text fig. 7. Arrangement of eye-spots in *Eurylepla punctata* sp. nov. The sucker represents a small cup-shaped disc, occupying a position near the centre of the body on the ventral surface and receiving, as it does, the openings of numerous glands.

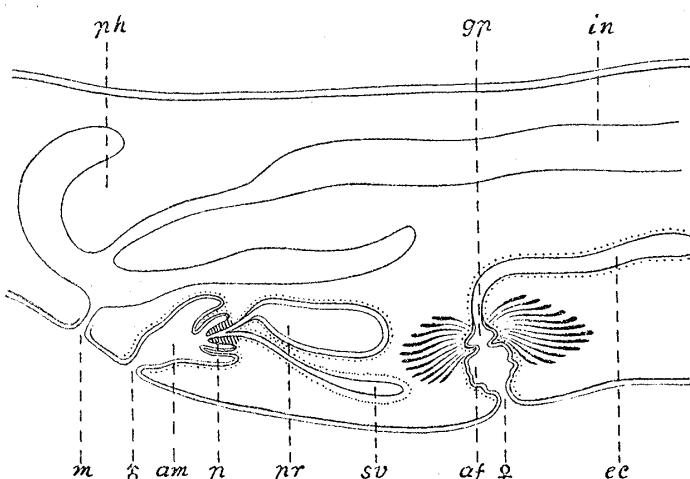
The mouth, lying a short distance behind the brain, opens into the pharyngeal chamber with the small cylindrical pharynx which is directed oblique-anteriorly. Posteriorly the pharynx continues into the main trunk of the intestine which runs along the median line, giving off some pairs of lateral branches which are repeatedly subdivided before reaching the margin of the body. The subdivisions of the intestine do not form any anastomosing system.

The male and the female gonopore are widely apart, the former being placed just behind the mouth.

The present species has the genital organs constructed on the same plan as found in the preceding species. Numerous testes occur distributed on the ventral side. The vasa deferentia, which are full of spermatozoa, pursue a forward course to open, each separately, into the seminal vesicle in front of the female organs. The vesicle is of a relatively wide canal, its direct wall being formed of a thin epithelium, outside which comes a muscular layer of moderate thickness. Anteriorly the seminal vesicle assumes the character of a slender canal, the ejaculatory duct, which proceeds forward and, after receiving the duct of the prostate, opens into the penis-sheath at the tip of the penis. As is the case with

other species of this genus, the prostate and the penis occur immediately beneath the pharyngeal chamber. The prostate is of a pear-like shape, its wall being made up of a thick epithelium of glandular nature and a moderately thick muscular layer composed of interlacing circular fibres. The penis is a slenderly conical body, oblique-anteriorly projecting into its sheath which is a dorsal continuation of the tubular antrum muscularum.

The ovaries are dorsally placed. The uterus, which is filled up with ripe ova, unites with its fellow of the opposite side into a single canal



Text fig. 8. Genital organs of *Eurylepta punctata* in sagittal section. Diagrammatic. *in* intestine, *m* mouth, *ph* pharynx. Other letters as in Text figs. 3 and 6.

slightly posterior to the female gonopore. The canal extends forward as far as the level of the gonopore and abruptly bends downward to connect with a small, moderately wide passage which is supplied with numerous glands embedded

in the parenchyma. The glandular passage in turn stands in communication with the antrum femininum which is tolerably wide.

So far as my observations go, the present species is very closely related to *Eurylepta aurantiaca* Heath and McGregor<sup>1</sup> from Monterey Bay, California; in fact, the terminal parts of the male genital organs in the two species have almost identically the same structure. However, they may stand distinctly at variance chiefly in the difference of colour and markings.

<sup>1</sup>) Heath and McGregor 1913, Proc. Acad. Nat. Sci. Phil., LXIV, 481.